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# REPORT ON

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# HARDY CREEK INTERCHANGE

REPORT ON HARDY CREEK INTERCHANGE

HARDY CREEK SOUTH

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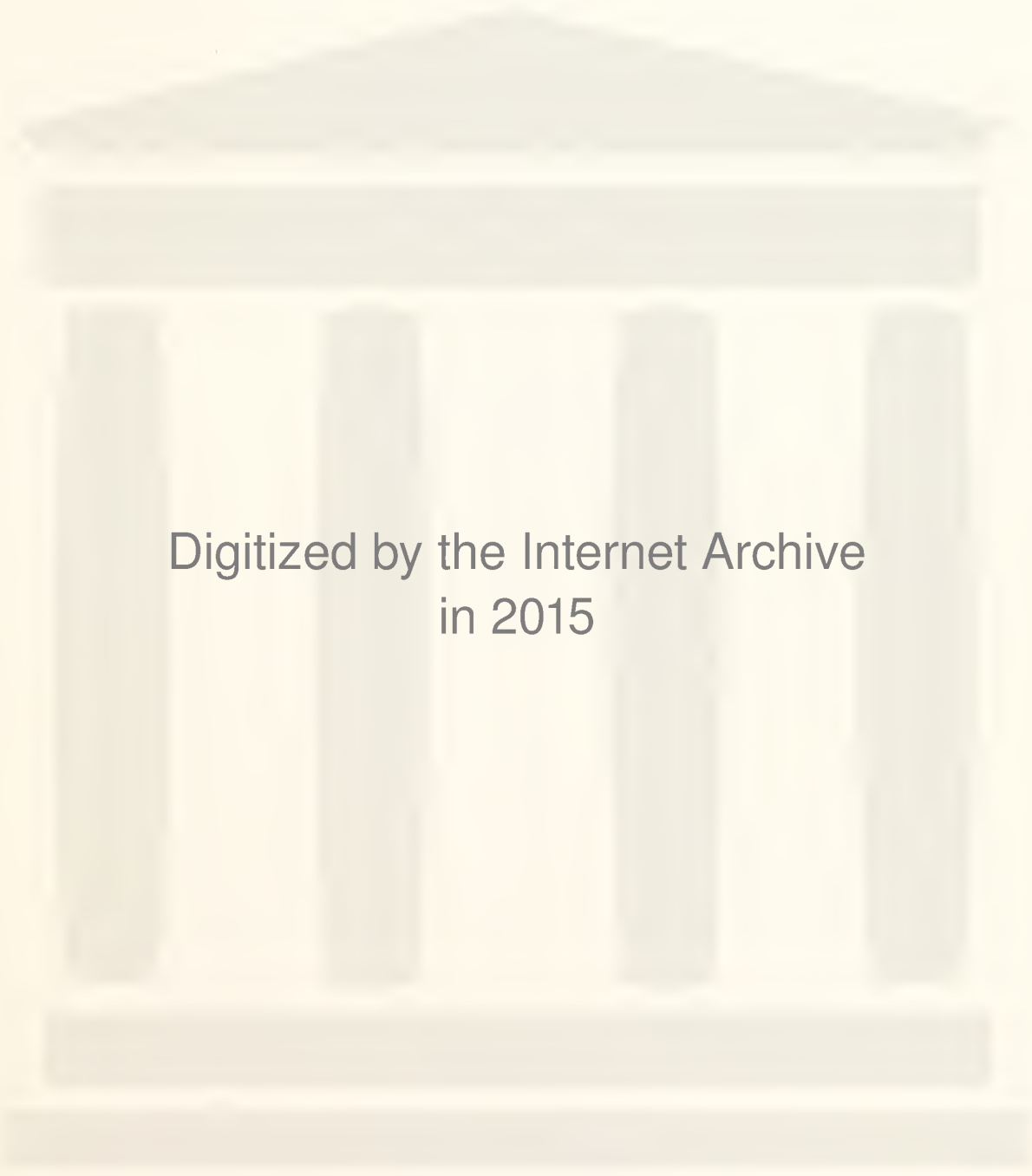

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# REPORT ON HARDY CREEK INTERCHANGE

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HARDY CREEK SOUTH

HIGHWAY COMMISSION

STATE OF MONTANA

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Helena, Montana
Project 275-08-38

April 7, 1964

# R E P O R T

on

# HARDY CREEK INTERCHANGE

The purpose of this report is to discuss the feasibility of an interchange at Hardy Creek. This interchange site is 8 miles south of Cascade. It is near the northern end of the Interstate project Hardy Creek-South which is now in the design stage. This project will adjoin the Hardy Creek to Cascade Interstate project on which construction was completed in 1963.

The Location Plan map shows the location and layout of the interchange in relation to other features. This interchange was not included in the original reconnaissance report of the proposed alignment through the Missouri River Canyon. It does, however, have merit and inclusion during initial construction should be given consideration.

## AREAS SERVED

The two main areas that would be served by this interchange are the tract developments adjacent to the existing highway south of the interchange area. The most northerly developed of the two areas served is the Siebold Tracts. In the summer of 1963, this development contained twenty-one homes and a trailer court. The Willington Tract farther south had twenty homes and five trailer houses in the same year. There are also a number of private land ownerships and dwellings adjacent to the tract areas as well as the Gueirin Quarry of the Great Northern Railway Company, which require access.

## SERVICE ROAD REQUIREMENTS

A bridge over Hardy Creek is necessary for the Interstate. Lateral clearance will be provided under the structure on the north side of Hardy Creek for a two-lane road. The two-lane road is necessary with or without the interchange ramps. Without ramps the structure serves as a grade separation only.

West of this new structure the crossroad would connect to the existing highway at a point immediately north of the existing highway bridge over Hardy Creek. The existing highway would remain south of Hardy Creek for service to the whole area.

East of the new Interstate bridge over Hardy Creek the crossroad would be constructed to the north for a half mile and connect to the two-lane frontage road now in place. This road runs parallel with the existing Interstate Highway to the Tintinger Interchange where access to the Interstate could be obtained. The crossroad under the bridge also serves as access to the field north of Hardy Creek which is segregated by the Interstate Highway.

The present bridge over Hardy Creek is a three-span, reinforced-concrete, T-beam bridge. It was built in 1931 and is in good condition. The width between curbs is 22 feet and it is 96 feet long.

The material source area and the stockpile area of the Great Northern Railway quarry south of Hardy Creek are also segregated by the Interstate. Since Hardy Creek is dry most of the year and the stream bed can be crossed east of the proposed bridge when dry, it appears that no separate road access under the bridge for the railroad property is required.

The grade separation becomes an interchange by the addition of ramps. Only two ramps are required since there would be very little need for service from the Interstate south at this point. Since the two tract areas are over a mile south of Hardy Creek the natural traffic flow would be to the Canyon Interchange for movements to and from the Interstate south.

With the two ramps provided as illustrated on the map local traffic would have direct access to the Interstate at Hardy Creek instead of having to travel a longer distance to the Tintinger Interchange on a lower type road.

The frontage road alignment on both sides of the proposed Interstate bridge over Hardy Creek is far from ideal, due to the sharp curves. However, this is

the only alignment possible if the usage of the present highway bridge over Hardy Creek is used as a control. The sharpest curve is a 20 degree curve. This curvature is the same as the curve at the west end of the bridge over the Missouri River two miles south.

The proposed ramp layout is similar to the general pattern for a diamond type interchange but includes only 2 ramps. Turn conditions on and off the ramps at the frontage roads are near stop or slow speed conditions as is usually the case with diamond interchanges.

The usage of the interchange is largely expected to be by drivers who make repeated trips and become familiar with the layout. Proper signing would be essential to safe operation but would not be a problem.

If the interchange ramps are not built, there is no reason for stop requirements for the traffic on the frontage road. Without considerably improved alignment, the geometrics as shown for through traffic are not as good as for resultant traffic movements with the ramps. The frontage road curve on the south side of the Interstate could be flattened by taking more of the field. However, the curve alignment on the frontage road could not be improved without abandoning the present highway bridge over Hardy Creek and building at additional cost a new skewed bridge downstream.

Considering that this road system is for local use and that high speed, through traffic will be using the Interstate, the traffic volume does not seem to warrant higher standards. If considerations were given to improved realignment of the frontage road, in comparison the additional cost for the interchange ramps becomes smaller and appears to be more justified.

## ECONOMIC ANALYSIS

A comparison of road user benefits and additional construction costs has been made in accordance with current practice of the Highway Department. Since four

lanes are justified with or without the interchange, the only additional construction costs are for the two ramps.

The Traffic Plan shows distances and traffic volumes for the year 1985. The road user operating costs have been computed for the distances involved from Point A at Hardy Creek to Point B at the Tintinger Interchange. The same traffic volume of 160 ADT has been used for both the travel on the Interstate with the interchange and on the frontage road without the interchange. In computing road user costs, the traffic volume has been adjusted for 6% commercial vehicles. This is the same percentage as was used on frontage roads in original reconnaissance report for this area. This cost study shows that the annual road user cost is $3,458 more for travel on the frontage road than on the Interstate.

The construction cost for the interchange ramps and features is $28,810. This considers maximum utilization of the Transition to P.T.W. on the constructed Hardy Creek-Cascade Interstate for the exit ramp, Ramp B2. This can be done without detriment to grades or alignment. There would be no added right-of-way cost for ramps. The right-of-way cost would probably be higher but by an inappreciable amount without the ramps. This would be due to taking more R/W for improved alignment due to larger traffic volume on the frontage road without the ramps.

A credit of $8,437 against the cost of the interchange is also shown to reduce the net cost of the interchange to $20,373. This is the difference in the cost between plant mix surfacing and gravel surfacing for the length of two-lane frontage road from the proposed structure over Hardy Creek to the existing frontage road one-half mile to the north. This is on the basis that without the interchange the new section of frontage road would be paved since it will connect with pavement at both ends.

The cost of gravel surfacing and grading of the new section of frontage road has not been deducted from the cost of the Interchange. This is based on the recommendation that this short section of frontage road be constructed as a graveled road for continuity of the local frontage road system.

The initial construction cost for the interchange ramps prorates to $1,619 per year when using standard life expectancies for construction and an interest rate of 6%. This results in a benefit cost ratio of 2.14.

The traffic distribution furnished by the Montana Highway Department indicated that some of the northbound vehicles from the Willington Tract would travel south, gain access to the Interstate at the Canyon Interchange, and then proceed north. This movement would be in lieu of direct travel north on the frontage road with Interstate access obtained at Hardy Creek. However, this distribution would result in fewer cars using the interchange and a greater difference in road user costs due to out-of-direction travel. This would tend to show an even greater economic benefit. It is believed that the most conservative approach has been used in the computations shown so as not to disproportionately favor a high cost benefit.

## CONCLUSION

The Hardy Creek Interchange shows more savings in road user costs per year than expenditures in additional construction cost per year and on this basis can be considered as a good investment. Aside from the foregoing fact, the total outlay for the construction cost for this facility is very low. For the service it will provide to the residents of this area it appears to be a very favorable feature.

## RECOMMENDATION

Based upon its desirability and economic benefit it is recommended that the Hardy Creek Interchange be approved for inclusion in the plans and proposed construction of the Hardy Creek-South Interstate Project.

## HARDY CREEK INTERCHANGE

## QUANTITY AND CONSTRUCTION COST SUMMARY

### GRADING & DRAINAGE

Grading

| | | | |
|---|---|---|---|
| Exc. 7,792 Cu. Yds. | @ $0.40/C.Y. | = $3,117 | |
| Drainage | | | |
| 2-24" x 50' Culvert | @ $15.00/LF | = $1,500 | |
| Cattle Guards | | | |
| 2 - 8' x 24' | @ $1,500 ea | = $3,000 | |
| | | | $ 7,617 |

### SIGNING

| | | |
|---|---|---|
| Lump Sum | | $ 5,000 |

### SURFACING

| | | | | |
|---|---|---|---|---|
| Ramp $B_2$ = $ 5,307 | | | | |
| Ramp $B_3$ = $10,886 | | | | |
| | | | | $16,193 |
| Surfacing of paved frontage road if Interchange is not built | | $12,088 | | |
| Surfacing of graveled frontage road if Interchange is built | | 3,651 | | |
| | | | (-) | $ 8,437 |
| TOTAL CONSTRUCTION COST OVER CONSTRUCTION COSTS WITHOUT INTERCHANGE | | | | $20,373 |

Note:

| | | |
|---|---|---|
| Ramp Surfacing | @ $738/Sta. | (2.0' thick) |
| Paved Frontage Road Surfacing | @ 490/Sta. | (1.4' thick) |
| Graveled Frontage Road Surfacing | @ 148/Sta. | (0.5' thick) |

## HARDY CREEK INTERCHANGE

## ANNUAL ROAD USERS COSTS

Costs to Road User with Hardy Creek Interchange or without Hardy Creek Interchange differ only by the length of travel on the Frontage Road.

### WITH HARDY CREEK INTERCHANGE

| Location and Description | ADT 1985 A* | UNIT COST $ /Mile U | LENGTH Mile L | ROAD USERS COST A x U x L x 365 |
|---|---|---|---|---|
| Hardy Creek Bridge to Hardy Creek Interchange (Frontage - "A" to "C") | 185 | 0.1230 | 0.46 | $ 3,821 |
| Hardy Creek Interchange to Transition (4-lane Interstate-"C" to Transition) | 185 | 0.0942 | 0.20 | $ 1,273 |
| Transition to Tintinger Interchange (2-lane Interstate-Transition to "B") | 185 | 0.1103 | 1.45 | $10,800 |
| | TOTAL | | | $15,894 |

### WITHOUT HARDY CREEK INTERCHANGE

| Location and Description | ADT 1985 A* | UNIT COST $ /Mile U | LENGTH Mile L | ROAD USERS COST A x U x L x 365 |
|---|---|---|---|---|
| Hardy Creek Bridge to Tintinger Interchange (Frontage-"A" to "B") | 185 | 0.1230 | 2.33 | $19,352 |
| | TOTAL | | | $19,352 |

* 160 Vehicles Adjusted for 6% commercial vehicles

Annual difference in Road User Costs $ 3,458

(ADT is Average Daily Traffic)

## HARDY CREEK INTERCHANGE

## ANNUAL CONSTRUCTION COSTS

| ITEM | COST | LIFE | K* | ANNUAL COST |
|---|---|---|---|---|
| Grading & Drainage | $ 7,617 | 40 | 0.0665 | $ 507 |
| Signing | 5,000 | 20 | 0.0872 | 436 |
| Surfacing | 7,756 | 20 | 0.0872 | 676 |
| TOTAL ANNUAL CONSTRUCTION COST OVER CONSTRUCTION COSTS WITHOUT INTERCHANGE | | | | $1,619 |

* Capital Recovery Factor @ 6%

## TOTAL OF ALL ANNUAL COSTS

A COMPARISON OF ANNUAL COSTS WITH AND WITHOUT THE HARDY CREEK INTERCHANGE SHOWING THE COMPARISON OF COSTS THAT ARE NOT IDENTICAL

WITHOUT HARDY CREEK INTERCHANGE

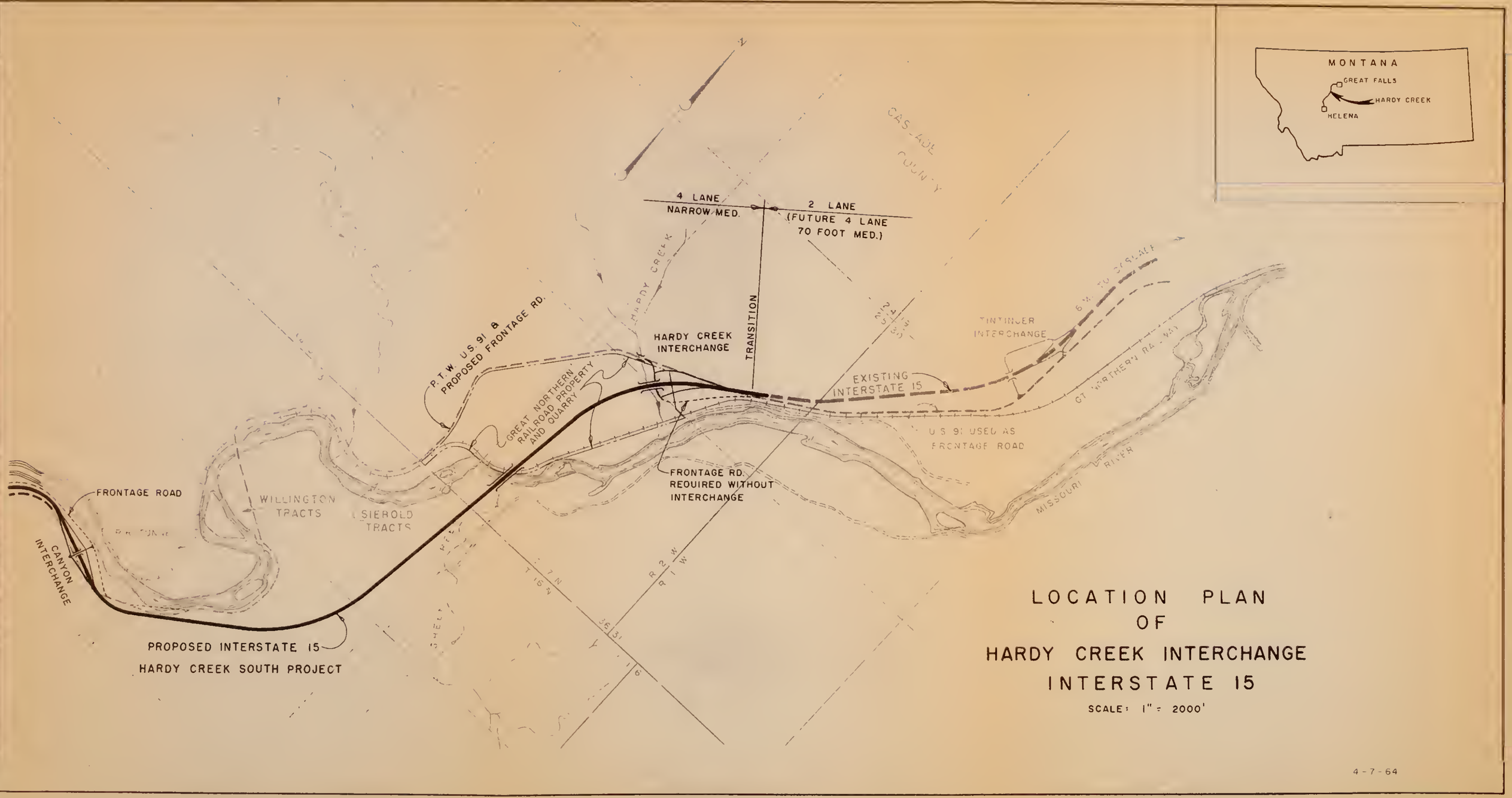
| | | |
|---|---|---|
| Total Annual Road Users Operating Costs | | $19,352 |

WITH HARDY CREEK INTERCHANGE

| | | |
|---|---|---|
| Total Annual Construction Costs | $ 1,619 | |
| Total Annual Road Users Operating Costs | 15,894 | $17,513 |
| TOTAL ANNUAL SAVINGS IF HARDY CREEK INTERCHANGE IS CONSTRUCTED | | $ 1,839 |
| SAVINGS IN 20 YEARS | | $36,780 |

## BENEFIT - COST RATIO

$$\frac{\text{Annual Savings in Operating Costs}}{\text{Annual Construction Cost Difference}} \qquad \frac{\$19,352 - 15,894}{\$\ 1,619} = 2.14$$




# LOCATION PLAN OF HARDY CREEK INTERCHANGE INTERSTATE 15

SCALE: 1" = 2000'

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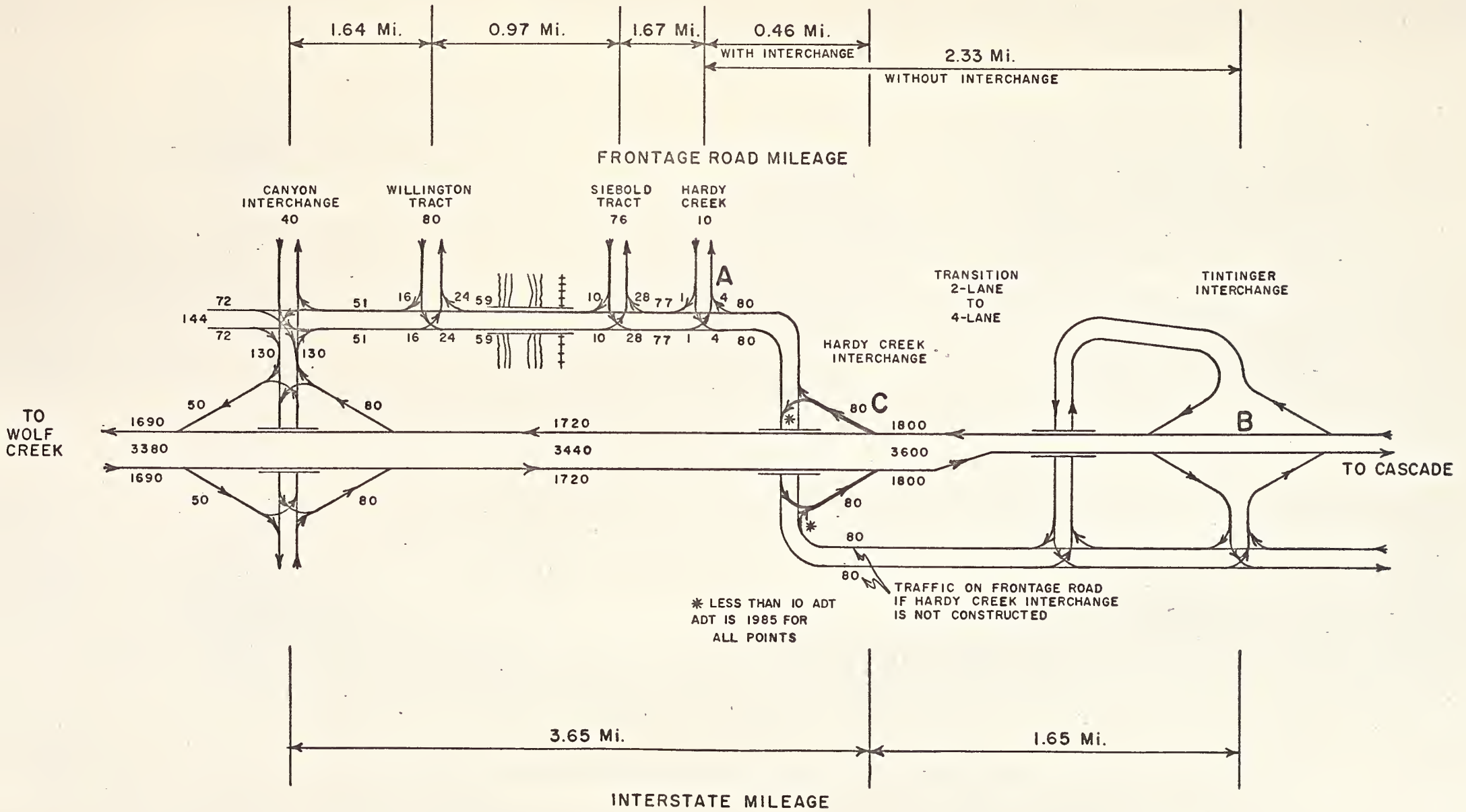
# TRAFFIC PLAN

## HARDY CREEK - SOUTH

## AVERAGE DAILY TRAFFIC (ADT) AND MILEAGE

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ESTIMATED 1985 ADT

* DENOTES LESS THAN 10

HARDY CREEK INTERCHANGE
TRANSITION - 4 LANE TO 2 LANE

SCALE: 1" = 100'

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